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Long-term Management of Patients After Weight Loss Surgery

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ABSTRACT

Bariatric surgery is becoming very common, and most physicians will have contact with bariatric patients. Many aspects to follow-up are not generally known. The objective of this article is to help other physicians understand what follow-up entails to assist them with the care of these patients. It is expected that patients are followed up by the bariatric team for a lifetime, as care is complicated and lifetime follow-up is the key to long-term success.

INTRODUCTION

Bariatric surgery improves quality of life and comorbid conditions and decreases overall cost of care.[1] Patients who undergo surgery will likely increase the length of their lives due to improvement in diabetes and heart disease and decreased risk of cancer.[2,3] Long-term bariatric follow-up requires a team approach and attention to several aspects of care. Nutrition is the most important aspect of follow-up to safely maximize weight loss and prevent weight gain. Exercise helps to maintain weight loss. Complications need to be identified early and can result from improper behavior or from surgical complications. Emotional difficulties occur in many patients. This article addresses all these factors.

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GENERAL FOLLOW-UP

Two common procedures performed for weight loss are the laparoscopic adjustable gastric band (LAGB) and the laparoscopic Roux-en-Y gastric bypass (LRGBY). The LRGBY constitutes 80% of all bariatric procedures.[4,5] The main factors contributing to successful weight loss after bariatric surgery are the patient's ability to make lifestyle changes and to maintain those changes for years to come following the surgery. Success is measured by excess body weight (EBW) loss, which is current body weight minus ideal body weight. After LRGBY, 80% of patients achieve greater than 70% EBW loss over 2 years, and 70% of patients after LAGB achieve greater than 50% EBW loss over 3 years.[4] Those who maintain the lifestyle changes for the rest of their lives will maintain the weight loss. These changes include following a healthy well-balanced diet, taking the recommended vitamin supplementation, and exercising regularly (we recommend exercise for 30 minutes ≥5 d/wk).[6] In some patients with severe physical disabilities, physical therapy is often used to help them become mobile and to incorporate the appropriate amount of exercise.[6]

During the period of weight loss, we closely observe our patients; we then follow up with them once a year. During these visits, patients commonly have appointments with multiple persons on the bariatric team, including the surgeon, a physician extender, a registered dietician, and/or a mental health care provider, depending on the needs of each patient. All team members are important to guide, support, motivate, and educate the patient continuously, so that he/she may achieve a healthy weight after surgery.[4] Adjustments to LAGBs are required regularly during the first 2 years to maintain the ''green zone,'' at which patients are eating properly and feeling satiated with their small meals for 2 to 3 hours. Later adjustments are needed every year or two as saline slowly leaks out of the band.[7,8]

In the early postoperative period, the main goals of office visits are to assess proper nutrition status, identify maladaptive eating disorders, evaluate potential complications (internal hernia, ulcers, etc), monitor status of comorbidities, encourage regular

exercise, discuss weight loss progress, and check laboratory values (vitamin B_1, vitamin B_{12}, magnesium, phosphorous, blood counts, albumin, and a metabolic profile). For most patients, this is a time of emotional turmoil. Family physicians are intimately involved during the period of weight loss because of the changes in comorbidities and in medication requirements.[4]

During the patient's consultation with the dietician before surgery, specific weight loss goals are calculated based on EBW. After LRGBY, 80% of patients achieve greater than 70% EBW loss over 12–18 months, and 70% of patients after LAGB achieve greater than 50% EBW loss over a 2-year period.[9] The slower weight loss with LAGB is sometimes discouraging to patients.[4]

Successful weight loss also results in resolution or improvement of associated comorbidities. Particularly after LRGBY, type 2 diabetes mellitus is commonly in remission on postoperative day 1 and at a bare minimum is better controlled with less medication. Blood pressure should also be managed closely within the first 3 months, but improvements are seen over the first year. Improvement is also noted in arthritis, heart function, and stress incontinence, among other medical problems.[4,10–14] The use of diuretic agents should be reduced or discontinued in the first month or so to avoid dehydration and electrolyte abnormalities.[15,16] The first sign of blood pressure improvement is often light-headedness. Lipid changes are seen during the first year.[17] Sleep apnea resolves in most patients, which may require successive sleep studies.

Depression and anxiety medications should be continued for at least the first 6 months. Symptoms of depression should be monitored closely at the first few appointments. Many patients have difficulty with the extreme and instant lifestyle changes. If patients were previous stress eaters and become stressed after surgery, they no longer have the ability to eat for stress relief. After LRGBY, patients usually will experience dumping syndrome (which includes abdominal pain, nausea, vomiting, diarrhea, and diaphoresis). Many patients also experience changes in their social scenes, as many American holidays are centered on a big meal. The way patients interact with the significant people in their lives changes dramatically, and their social structure can be irreparably broken. This is challenging, but patients can overcome these difficult situations with guidance, understanding, and professional counseling when needed.[4,18]

Maintenance of weight loss is obtained by following a healthy balanced diet with regular exercise every week. Weight regain is a warning sign. The most common factors leading to weight gain after weight loss surgery are decreased exercise and a return to preoperative eating habits.[16] Patients who have undergone LRGBY may experience a decrease in dumping symptoms and a resolution of food intolerance, making it easier for them to eat more.[19,20] Patients can become discouraged or embarrassed and may not return to the bariatric provider who performed their surgery. They sometimes return many years later at their presurgery weight and request a revision. It is best for patients to return to the bariatric team at the earliest signs of weight regain. If weight regain is caught in its early stages, it is easier for patients to get back on track. Regain of weight can be due to changes in operative anatomy and requires workup, but the most common causes are changes in diet, lack of exercise, or psychological issues.[4]

Inadequate weight loss must also be addressed early by assessing eating practices, psychological status, and fluoroscopic images to rule out fistulas between the gastric pouch and remnant. Most commonly, the cause of poor weight loss is increased caloric intake or increased consumption of calorie-dense foods. Again, close follow-up with a bariatric dietician is needed, as well as addressing any psychological issues.[21]

Early satiety is an expected adverse effect of surgery for LRGBY and LAGB. Dumping, which occurs only after LRGBY, can be viewed as a negative adverse effect, but it can be used by the patient as a teaching tool. The surgical weight loss program retrains patients to lead a healthy lifestyle. The phrase ''eat to live and not live to eat'' comes to mind. The reasons for weight gain should be discussed before surgery, and while it may be difficult to overcome these factors, it is possible.[4]

When patients complain of frequent abdominal cramping and vomiting after eating, the first step is an evaluation of foods that are eaten before these symptoms occur. If symptoms commonly occur after LRGBY with intake of high-sugar and high-fat foods, the likely cause is dumping. After LAGB, solid food intolerance can be a result of overinflation of the band. When patients complain of food intolerance, complications of surgery need to be evaluated. Our dietitian evaluates these patients for improper eating behavior.

Medications for all weight loss patients need to be in crushed, liquid, or chewable forms during the first 6 months for LRGBY and for the patient's lifetime after LAGB. The use of whole medications may lead to ulceration as they sit in the stomach pouch or pouch enlargement. Nonsteroidal anti-inflammatory drugs are contraindicated after LRGBY because of the incidence of ulcers.[4]

NUTRITION FOLLOW-UP

The main goals after any bariatric gastric surgery are threefold: (1) to maximize weight loss and absorption of nutrients, (2) to maintain adequate hydration, and (3) to avoid vomiting and dumping syndrome.

To assess proper nutrition, we ask our patients to bring a 24-hour recall of dietary intake to their appointment. We ask them to consume at least 64 oz of fluids daily, while avoiding sugary beverages and alcohol. Diet after gastric surgery may be inadequate because of the limiting size of the stomach pouch, which results in the patient eating smaller amounts of food. Protein intake is often a problem and is likely less than the 1.5 g/kg of ideal body weight. Most patients are able to consume 0.8–1 g of protein/kg of ideal body weight from a combination of foods and liquid supplements, which ends up being about 60–80 g of protein daily. Much of the nutritionist's work is related to informing patients how to eat properly and how to judge fluid, protein, carbohydrate, and fat intake. The importance of self-monitoring by means of keeping daily food records is emphasized from the initial visit.

Mealtime guidelines are provided to encourage fluid intake and to maximize satiety between meals.[22] Five guidelines for fluid consumption are as follows:

- No liquids at meals; wait at least 30 minutes after a meal to start fluids. It is important to avoid overfilling and stretching the stomach pouch.
- Sip beverages; do not use a straw, which increases swallowed air.
- The daily goal is at least 1.4 L (6 cups) of fluids. This should include high-protein liquid supplement, skim milk, and sugar-free noncarbonated beverages. Decaffeinated coffee or tea is preferred.
- Stop eating and drinking when a full feeling occurs. Overfilling the stomach pouch will cause it to stretch, which often leads to increased intake.
- Avoid carbonated beverages, as the gas bubbles may stretch the pouch.

All patients with bariatric gastric procedures are at risk for nutrient deficiencies. Because Roux-en-Y gastric bypass is a malabsorptive operation, it carries greater risk for nutritional deficiencies than the restrictive procedures. This is because malabsorptive procedures cause food to bypass parts of the duodenum and jejunum, where most iron and calcium are absorbed. Menstruating women are especially prone to developing anemia because insufficient vitamin B_{12} and iron are absorbed. Decreased absorption of calcium may cause osteoporosis and metabolic bone disease. Patients are required to take nutritional supplements that usually prevent these deficiencies.

Etiology of Protein, Calcium, Iron, and Vitamin B_{12} Deficiencies and Recommended Supplements

Information in this section about recommended supplements is taken from the *ADA Nutrition Care Manual*.[22]

Protein deficiency is caused by inadequate ingestion of protein due to small pouch size. Patients should eat high-protein foods (eg, meat, eggs, and cheese) before vegetables, fruit, or grains. Supplements should include protein isolate powder in milk or other liquids. The minimum amount of protein is 60–80 g/d. The goal is 1.5 g/kg of ideal body weight.

Calcium deficiency occurs because primary absorption sites (duodenum and proximal jejunum) may be bypassed. Supplementation should include 1,000–1,200 mg of calcium citrate. Calcium carbonate is not absorbed as well. If the patient uses chewable calcium carbonate tablets (eg, Tums), the dosage should be increased to 2,000 mg/d. Vitamin D should be included with calcium supplements.

Iron deficiency also occurs because primary absorption sites (duodenum and proximal jejunum) may be bypassed. The intake of foods high in iron is decreased because consumption of red meat is poorly tolerated by some patients. Absorption of iron is decreased because less gastric acid is available. Menstruating females are more susceptible to iron deficiency and anemia. If iron deficient, patients should take 325 mg of iron sulfate with vitamin C for increased absorption.

Vitamin B_{12} deficiency occurs because of inadequate contact with intrinsic factor resulting from low intake of foods rich in vitamin B_{12} owing to the small size of the stomach pouch. Physicians should monitor this in patients and supplement their diets with sublingual oral crystalline vitamin B_{12} (500 μg) or monthly injection as needed.

Etiology of Thiamin (Vitamin B_1) and Folate Deficiencies and Recommended Supplements

Thiamin deficiency is caused by inadequate dietary intake, as primary absorption sites may be bypassed.[23] Clinical presentations have included acute Wernicke encephalopathy (nystagmus, ophthalmoplegia, ataxia, and confusion), lower limb hypotonia, seizures, polyneuropathy, unsteady gait and ataxia, and hearing loss. Severe deficiency is associated with beriberi. Dry beriberi is the development of a symmetric peripheral neuropathy characterized by sensory and motor impairments mostly of the distal extremities, as demonstrated by difficulty in rising from a squatting position. Wet beriberi manifests as cardiac impairment with peripheral vasodilation, cardiomyopathy, congestive heart failure, edema, tachy-

cardia, peripheral neuritis, and Wernicke-Korsakoff syndrome. Diagnosis can be made by measuring erythrocyte transketolase activity, blood thiamine concentration, or transketolase urinary thiamine excretion. Patients should receive daily B-complex supplements to prevent deficiency. Treatment for acute deficiency manifested by cardiovascular or neurologic signs involves administration of supplemental thiamine, starting with 100 mg/d intravenously for 7 days, followed by 10 mg/d orally until there is complete recovery.

The cause of folate deficiency is unknown. Deficiency is usually prevented if the individual takes a daily multivitamin.

Guidelines for Administration of Supplements

- One chewable vitamin/mineral tablet should be taken at breakfast and at dinner for 6 months after surgery. After 6 months, many gastric bypass patients elect to switch to an adult vitamin tablet that they can swallow. Gastric band patients are advised to always use chewable vitamins. Centrum® makes an adult chewable vitamin. Prenatal vitamins are good for individuals who need extra iron.
- Calcium citrate should be taken at midmorning and at midafternoon. The dosage is 500–600 mg twice daily.
- A B-complex vitamin with at least 10 mg of thiamin should be taken. Also needed is a vitamin B_{12} sublingual dot (500 μg daily, 1,200 μg biweekly, or 2,500 μg weekly) or a monthly injection of 1 mL.
- If extra iron is needed, it should be taken with vitamin C. Allow 2 hours or longer between iron and calcium supplements to avoid interference with absorption.

Common Nutritional Problems and Prevention Tips

Nausea and vomiting are caused by overeating or by eating too quickly. To prevent this, patients should eat slowly, chew foods very well, and stop eating as soon as they feel full.

Chronic malnutrition problems occur because nutrients are absorbed differently following surgery. Symptoms are fatigue, aching muscles, and tingling feet, calves, or hands. To prevent malnutrition, patients should consume a healthy diet and always take vitamin/mineral supplements as directed.

Lactose intolerance is characterized by gas, bloating, cramping, and diarrhea after drinking milk. Prevention tips are to drink smaller amounts of milk at a time, to use lactose-free or lactose-reduced milk, or to try soy milk.

Temporary hair loss is caused by rapid weight loss and/or lack of protein or vitamins/minerals in the diet. To prevent this, patients should consume the amount of protein recommended and take vitamins/minerals as directed.

Dehydration is caused by consumption of insufficient fluids or by persistent vomiting. Symptoms include dark and strong smelling urine, dry mouth, headache, and fatigue. To avoid this, patients should sip liquids frequently throughout the day.

Dumping syndrome is caused by food emptying too quickly from the stomach. Symptoms include diarrhea, nausea, cold sweats, and light-headedness. Prevention tips are to avoid consuming refined sugars and high-fat foods and to wait 30 minutes after meals before fluid intake.

Constipation occurs because the intake of food and fiber is reduced following surgery. Prevention tips include drinking plenty of water, exercising daily, taking a fiber supplement such as Benefiber, and eating sugar-free applesauce, oatmeal, or prunes daily.

We understand that what we think patients should ideally eat and what they actually will eat are different. We try to help them alter their dietary behavior to maximize weight loss and absorption of nutrients. We try to identify maladaptive eating disorders such as ingesting high-calorie liquids or foods, binge eating, or starvation. A patient struggling with maladaptive eating disorders should not be difficult to recognize if the right probing questions are asked. Most commonly seen are patients more than 1 year after surgery who begin to gain back weight. While a small percentage of patients can gain back weight because of surgical complications such as stretching of the anastomosis or stomach pouch, most patients are just taking in too many calories. They may not realize where all of their calories are coming from if they are not keeping detailed food records. Patients complaining of weight regain should be referred back to the bariatric team to be evaluated for surgical complications or for excess calorie intake. At the other end of the spectrum are patients who may be struggling with their body image and self-esteem, causing them to skip meals or even to starve themselves. These patients are terrified that they will gain weight back and will benefit from regular visits with a therapist to help them overcome their fears and create a healthy body image. These patients should also be referred back to their bariatric dietitian, who can help them set up a nutritious meal plan.

Weight loss surgery is merely a tool that helps people get a new start toward maintaining long-term good health. The surgery alone will not help someone lose weight and keep it off. Together with a reduced-

calorie and low-fat diet and daily exercise, surgery will help an individual lose weight and maintain the weight loss. Following the guidelines about food choices and physical activity will promote adequate weight loss and maintenance. Unfortunately, most patients will be unable to attain ideal body weight, so the goal is to maintain 70% EBW loss for LRGBY and 50% for LAGB. It is important that patients understand and accept this and are able to set realistic goals for themselves.

LATE COMPLICATIONS FOLLOWING BARIATRIC SURGERY

Bariatric surgery has great benefits for most patients and improves survival and quality of life even when the risks of surgery are taken into account. Although LRGBY has a higher initial complication rate than LAGB, LAGB has a higher complication rate in the long term. Most late complications are easily repaired as long as the symptoms are recognized early.

Laparoscopic Roux-en-Y Gastric Bypass

Stomal stenosis occurs in 4.7% of patients.[24] Stenosis usually presents as odynophagia/epigastric pain, nausea, or vomiting and can be associated with ulceration, which can be complicated by bleeding, perforation, or malnutrition. Esophagogastroduodenoscopy is the appropriate diagnostic tool. Ulcers may be prevented by using proton pump inhibitors and by avoiding nonsteroidal anti-inflammatory drugs and smoking. Stenosis without ulcers is treated by dilation, but ulcers require twice-daily treatment with proton pump inhibitors and sucralfate, and H_2 blockers are added if the ulcers are difficult to treat. For protracted ulcers, treatment of possible *Helicobacter pylori* infection is initiated even if cultures are negative. Patients may develop complications if they become malnourished and may require intravenous nutrition. When dilation fails to dilate a stricture or if follow-up esophagogastroduodenoscopy shows continued ulceration, surgery is indicated.

Bowel obstruction occurs in 3.1% of patients. This can be insidious but usually presents as crampy abdominal pain associated with nausea or vomiting. Symptoms may come and go or may be constant. Delay in diagnosis can lead to bowel infarction and short-bowel syndrome. Computed tomography is the best initial examination unless the patient requires early operation. Computed tomography can miss this complication, and diagnostic laparoscopy may be required. The causes are hernia, adhesions, or internal herniation, in which the bowel herniates through a mesenteric defect. Internal herniation is the most common cause, and surgery is required to repair the mesenteric defect.

Incisional hernia occurs in 0.7% of patients. Although bowel obstruction is possible, it usually causes local pain or reducible mass near the skin incision of a trocar site. This can generally be identified on physical examination, but computed tomography may be necessary. Surgical repair is indicated to avoid incarceration or bowel obstruction.

Nutritional complications occur rarely if patients are taking vitamins. Because complications of vitamin malnutrition can be severe, routine blood work is necessary, and intravenous therapy should be instituted if a patient has protracted vomiting, nausea, or obstruction. When oral intake does not replete vitamin levels, intravenous therapy may be necessary.

Laparoscopic Adjustable Gastric Band

Slippage or pouch dilation occurs in 12% of patients.[25,26] Symptoms include epigastric pain, nausea, and vomiting. Although this complication usually is unavoidable, eating slowly and not overfilling the gastric pouch may help prevent it. If the patient is in extremis, early operation is required to avoid gastric resection for ischemia or perforation of the slipped segment. Symptoms usually are not so severe, and we are generally able to perform band repositioning or removal.

Esophageal dilation occurs in 2% of patients. It is usually insidious with late onset of inability to tolerate food. The cause is unknown. Esophageal dilation is treated by band deflation or by removal of the band if dilation is severe.

Erosion of the band into the stomach occurs in less than 1% of patients. Symptoms include lack of restriction, latent port infection, and dysphagia or epigastric pain. The patient may also be asymptomatic. It is identified by esophagogastroduodenoscopy and is usually missed on upper gastrointestinal series. This complication requires removal of the band and port.

Obstruction occurs in 2% of patients and manifests the same symptoms as slippage and gastric pouch dilation. Rarely, patients have obstruction immediately after placement of the band. This will usually improve in a few days. After adjustment has been performed, deflation of the band usually resolves symptoms. If deflation of the band does not improve symptoms, an upper gastrointestinal series is performed to identify pouch dilation or slippage, followed by revision surgery or removal of the band.

Port complications occur in 7% of patients. There are several types of complications. Most common is a leak in the tubing or port itself, leading to inability to adjust the band and to loss of restriction to eating. Less common is port dislodgment from the muscle fascia, making it difficult to adjust the band. Treatment comprises port replacement or repositioning.

Nutrition complications occur rarely in band patients because these patients have no malabsorption; these complications typically occur only if the patient is unable to tolerate any oral intake for a prolonged time. Vitamins are still required after band placement, and serum vitamin levels are checked routinely. If a patient cannot consume oral intake for 5 days or longer, intravenous therapy is required.

CONCLUSION

Follow-up after bariatric surgery is critical and requires a team approach. For most patients, the benefits greatly outweigh the risks, and they are likely to have better and longer lives after surgery. Patients need to know that the surgery is a tool and that losing weight and keeping it off requires some work on their part particularly with regard to diet and exercise. For the best long-term results, follow-up is key.

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